HOW SAFE IS SAFE?

09H78000335

~~Information~~
~~Circ.~~ ~~Public~~
~~Director~~
~~Info. Staff~~
Library

HOW SAFE IS SAFE?

by David A. Lucht

Deputy Administrator

National Fire Prevention and Control Administration

U.S. Department of Commerce

Article Specifying Engineer Magazine. May 1978.

result. Fire Information by Kit Perrigo

1089

HOW SAFE IS SAFE?

. . . by David A. Lucht

How safe are we? How safe do we want to be? How do we measure safety? How do we decide?

While these are fundamental questions, they are asked all too infrequently in the fire safety field. Even when they are asked, practically no one can answer them. When fire protection experts do step forward to offer answers, their views are frequently received with question or doubt. Rexford Wilson, a leading fire protection engineer, recently put it this way: "We are perceived to be dealing in beads, trinkets and shells, while other professions are using mathematics, science and computers."

Whether or not we are consciously asking ourselves the important, basic safety questions, we are making safety decisions everyday. The decisions are made in many ways. Decisions are made by the national organizations which produce model codes and standards; decisions are made by the local officials who adopt those model codes and standards; decisions are made by the people who design our buildings.

When model codes and standards are written by such organizations as the Building Officials and Code Administrators International (BOCA), the Southern Building Code Congress (SBCC), the International Conference of Building Officials (ICBO), or the National Fire Protection Association (NFPA), they are written through the "consensus standards-making process." This means that people with varying views and backgrounds come together to work out what the substance and wording of the code or standard will be. Once agreement is reached, the text is submitted to a vote to formalize the consensus. The model code or model standard is then published for Federal, state or local consideration and adoption. By the time this process is completed, many decisions have been made; decisions as to how safe we are and how safe we are going to be.

Officials at the Federal, state and local level are responsible for the legal adoption of the model codes and standards. Often these officials simply adopt by reference the consensus achieved by the model code organizations. But sometimes changes are made. The factors which influence these changes are varied. They are often made in an environment of high emotion.

Following a nursing home disaster in the state of Ohio, for example, fire experts testified about what needed to be done to make nursing homes safer. Some said that plastic wastebaskets should be outlawed. Some said that carpeting should be outlawed. Some said that smoke detectors should be required because they respond quicker than sprinklers. Some said sprinklers should be required because they put the fire out. Some said that sprinklers should not be required because the water from the sprinkler system might make things worse rather than better. After government officials hear testimony such as this, they make their decisions. And these decisions are the ones that determine just how safe we will be.

Engineers and architects also make decisions that affect how safe we will be. Their design decisions are often based upon the minimum requirements of the codes in effect in their jurisdiction. Sometimes their design decisions are made with the benefit of consultation from a qualified fire protection engineer. Sometimes that fire protection engineer performs a systematic analysis of the building being designed to determine appropriate levels of safety. Systematic fire safety analysis such as this is rare, however.

If we are really going to reduce fire losses in the United States so that we are no longer a leading nation in per capita dollar loss and death rates, we must get ourselves out of the world of guesswork and emotion. We must enter into an era of "mathematics, science and computers"; a logical fire safety design method. We have to begin making more objective decisions about how safe we are going to be. More objective decisionmaking based on hard data analysis and a systematic weighing of alternatives must take place in the writing of our model codes and standards, in the adoption of those codes and standards, and in the design of our buildings.

LOGICAL FIRESAFETY DESIGN METHOD

Some fire experts claim to have a logical fire safety design methodology which enables them to determine how safe we are and to measure fire safety. The number of those fire experts is small and sometimes their analysis is viewed with doubt. Doubt is sometimes expressed by local building officials or fire officals who are not aware of the fire safety design method or are not convinced of its validity. A logical fire safety design method has not been thoroughly documented and judged by a legitimate nationwide professional organization.

The first systematic method for measuring fire safety was developed in 1902. In that year, A.F. Dean of the Western Board of Fire Underwriters published, "The Analytic System for the Measurement of Relative Fire Hazards." Dean's system assigned relative values to various fire protection characteristics of buildings. This system enabled a numerical evaluation of each building for fire insurance rating purposes. Using this scheme, the property insurance industry has determined fire insurance rates for different classes of buildings and uses with a variety of different fire hazards present. Using these rates, the industry has been able to derive fire insurance premiums which are adequate to cover operating expenses, loss payments, and profits through the years. Descendants of this analytical system are still being used today throughout the United States.

The International Conference on Fire Safety in High Rise Buildings, convened in April 1971 by the General Services Administration (GSA), Public Buildings Service, brought together 70 participants representing the many disciplines associated with fire safety design and planning. The summary report[1] of that conference contains the following significant statement:

---

1 "International Conference on Fire Safety in High Rise Buildings", April 12 - 16, 1971, Airlie House, Warrenton, VA. General Services Administration, Washington, D.C., 1971.

> "What follows (in the total report) is the beginning of a systems concept jelled from the deliberations of the conference for addressing the firesafety element in high-rise buildings. The ultimate objective is a system which can be integrated into a total systems design and management concept, considering functional goals and all required attributes of such buildings. This can be done by constructing a firesafe design and management system, identifying all major elements in that system, presenting recommendations for satisfying elemental requirements--including alternatives where they are known to exist--and by identifying a total system concept within which new solutions may be sought and gaps in knowledge filled."

In 1972 the General Services Administration published its "systems approach" in the "Interim Guide to Goal Oriented Systems Approach to Building Fire Safety"[2] for use in determining fire safety criteria for governmental buildings. Here the quantification of fire safety depends on a series of probability curves which describe GSA's fire safety goals and loss experience. The GSA curves are subjectively developed. This is the only

---

2 "Interim Guide for Goal Oriented Systems Approach to Building Fire Safety," General Services Administration, Washington, D.C., April 1972.

complete analytical system for probabilistic evaluation of the anticipated success in building fire safety performance.

The National Fire Protection Association created its Committee on Systems Concepts for Fire Protection in Structures, in June, 1972, making it "responsible for developing systems concepts and criteria for fire protection in structures." Based on work done by the National Bureau of Standards and the General Services Administration, the committee developed a "decision tree" which was published in 1974.[3]

The NFPA and the GSA decision trees describe relationships between elements which make up a building's firesafety system. Both show the hierarchy of conceivable factors and whether these act dependently or independently in the fire safety system. Each approach can be quantified. The NFPA decision tree is the more general form.

Today there are several variations of the systems approach in existence but few people know how to use them. What is worse, there is still debate among fire professionals as to which approach is better or in fact whether any of them are valid in the first place. As mentioned earlier, none of the firesafety systems anaylsis methods have been thoroughly documented and evaluated by nationally recognized professional associations.

---

3 "Decision Tree," Committee on Systems Concepts for Fire Protection in Structures, copyrighted November 1974, National Fire Protection Association, Boston, Mass.

WHERE DO WE GO FROM HERE?

If we are going to have an impact on reducing fire losses, a good place to start is with an objective approach to questions such as how safe are we and how safe do we want to be? The National Fire Prevention and Control Administration (NFPCA) is acting now to determine what we know and what we don't know in the area of systematic analysis of building fire safety. We want to identify what can be measured and what can't be measured. We want to determine the limits of the systems approach or the "decision tree." How can these approaches be used subjectively and how can they be used objectively?

NFPCA is working with the Society of Fire Protection Engineers (SFPE) to achieve this goal. A grant to the SFPE will support a project to assemble the current body of knowledge in fire protection engineering -- a systematic approach to identify and solve building fire safety problems. The result of this project will be a textbook describing the state of the art in building firesafety design. The text will include a description of the theory, approach and concept of a systems analysis procedure as well as fire protection engineering fundamentals.

This project will not include research to develop new technology. Rather, it will assemble the current state of the art into a coherent and understandable written form. The text will not be a cookbook; it will address concepts, techniques, and problem-solving logic. Also, the text will not describe how to design specific mechanical components such as sprinkler systems. Rather, it will address the question of how one should go about deciding whether or not a sprinkler system should be part of the building firesafety system. The text will not cover how to design or specify a fire wall. It will describe a procedure to follow in deciding whether or not a fire wall is needed as part of the building firesafety system. It is intended that this text will be a practical, working tool for use in the real world of solving today's firesafety problems.

OTHER FIRE ADMINISTRATION EFFORTS

The National Fire Administration has several other efforts underway to increase the use of systems analysis in firesafety decisionmaking. Two specific sections of the 1974 Fire Prevention and Control Act address building fire safety. Section 12,

"Review of Codes," requires the NFPCA to review fire prevention and building codes and "suggest improvements." It is felt that the National Fire Administration can make a significant contribution in this area by investing resources in the development of systems analysis and cost benefit analysis techniques which will help both those who write the codes and those who adopt and enforce them make more objective decisions. Section 13 of the Fire Prevention and Control Act is titled, "Fire Safety Effectiveness Statements." This Section of the Act is aimed at "consumer decisionmaking." Under this provision, the National Fire Administration will develop guidelines for measuring and documenting the relative safety provided by various types of buildings. On a voluntary basis, building owners and managers could apply these guidelines to derive firesafety measures for the public or the "building consumer." For example, someday the traveler may look at various hotel listings in his travel guide and see hotels classified as A, B, or C with respect to fire safety. If the traveler desires, he or she may decide which hotel to patronize based on the degree of firesafety provided. Obviously, a systematic and objective methodology must be

developed to derive these kinds of measures. Preliminary work to develop analytical techniques for both "review of codes" and implementation of the Fire Safety Effectiveness Statements Program is now underway through a grant to the Fire Protection Engineering Department at the University of Maryland.

Other work is also in progress to assist the building designer in firesafety decisionmaking. The NFPCA recently published "A Fire Protection Primer for Architects."[4] This Primer is probably one of the first of its kind in that it introduces the architect to firesafety design considerations in a form which the professional architect can most easily relate to. Also, the Fire Administration's National Fire Academy has a contract with the National Loss Control Service Corporation to develop a 30-hour firesafety design course for architects. This will be the first in a series of courses designed specifically for the building designer. It will introduce the student to some of the more fundamental concepts of building firesafety problems and their solutions. It is expected that this course will be ready in about six months; it will be disseminated in cooperation with the American Institute of Architects.

---

4 Lerup, Lars; Cronrath, David; and Liv, John Koh Chiang, "Learn From Fire: A Fire Protection Primer for Architects." University of California, College of Environmental Design, Architecture Life Safety Group, Berkeley, CA. 1977. Prepared for the National Fire Prevention and Control Administration, Washington, D.C., Grant number 75008.

The Fire Administration's National Fire Data Center is also making an important contribution. The collection and analysis of fire statistics are necessary in objective decisionmaking. The most sophisticated systems analysis techniques require the use of numerical values in making probabilistic determinations of events. Unfortunately, the United States has been sorely lacking in standarized, "processable" fire statistics. Three years ago, no two states collected fire data using compatible terminology and coding systems. The National Fire Data Center is working vigorously to increase standardization across existing data systems and to help states start up new systems. The Data Center adopted NFPA Standard No. 901, "Uniform Coding for Fire Protection,"[5] as a standard dictionary of terms and numerical codes. At this time, 19 states are in various stages of starting up or converting to standardized data systems. The Fire Administration is providing grants, computer software, training and materials to the various states to help them get into this National Fire Incident Reporting System. As this system grows and matures, our ability to conduct quantitative analyses will grow substantially. This will

5 "Uniform Coding for Fire Protection." National Fire Protection Association, Boston, Mass. NFPA No. 901-1976.

greatly reinforce and improve our ability to make objective decisions about how safe we are and how safe we want to be. As a result of the work done so far, the Fire Data Center is publishing "Fire in the United States"[6] which represents the most comprehensive and in-depth study of the nation's fire problem ever to be done.

HOW SAFE IS SAFE?

How safe is safe? Safe is as safe as we want it to be. We make decisions in this regard every day in the model codes and standards committees, in city councils and state legislatures, and in the design offices of professional architects. The problem is we do not know how safe our decisions are. If successful, the NFPCA/SFPE project will tell us how safe our decisions are; it will tell us what parts of our decisions must be based on judgement and what parts of our decisions can and should be based on fact. Hopefully, this project will also tell us where the voids are and where further work needs to be done to take more of the guesswork out of our important decisions which ultimately determine the safety of people from fire.

---

6 "Fire in the United States: Deaths, Injuries, Dollar Loss and Incidents at the National, State and Local Levels." National Fire Prevention and Control Administration, Washington, D.C., 1978.